to do so unless Italian archæologists support their words by actual deeds? One simple fact outweighs all their written and spoken utterances. Nowhere in Italy is any foreign enterprise at work, and never has any foreigner been invited to give his time and his talents to what is, in their own admission, a common cause. If Italian archæologists would pay to other nations the graceful compliment of employing, now and then, their students as assistants; if those derelict excavations on the shore of the Gulf of Taranto—whose need is so pressing and whose secrets are so necessary to history—could be, even temporarily, confided to foreign institutions; then, and not till then, their assurances would carry weight."

PROGRESSIVE WAVES IN RIVERS.[1]

THE stationary waves produced by the interaction of a rapid stream with its bed have been the subject of several investigations. The author finds that by a special mode of vision described in the paper the simultaneous presence of waves progressing down-stream can be readily detected.

In a very shallow stream with a steep channel, the progressive wave becomes the principal and obvious, instead of a subordinate and obscure, feature. In this case the velocity of flow is much reduced by friction. The slightest excess of retardation at any point momentarily increases the depth there, and increase in depth (where the depths are small) increases the velocity, at any rate in the upper layer. Continuous motion is therefore impossible, and is replaced by a gushing flow. If the bed be of nearly uniform cross-section, the gushes take the form of regular transverse progressive waves. If, on the other hand, the cross-section of the channel be very uneven, there may be no lateral coordination, and the intermittence of flow is only detected by the rushing sound and the beating action of the water against an immersed body.

Measurements showed that the total velocity of these roll-waves was equal to the velocity of the current *plus* the velocity of a long wave in water of the observed depth.

All waterfalls tend to break up into conical masses called water-rockets, and in rare cases a fall may be seen which consists of a slow procession of well-separated "rockets" ranged in roughly horizontal lines. A case is described in which this beautiful appearance was due to the formation of roll-waves above the fall.

Roll-waves spontaneously arising in very shallow conduits occur in groups, and the growth of amplitude and wave-length was measured in the case of the conduit of the Grünnbach at Merligen, on the Lake of Thun.

Roll-waves in shallow mountain rivers due to heavy rains in the gathering-ground of the tributary streams are solitary, and, coming without warning before the turbid waters arrive, are dangerous to anglers, who are familiar with the phenomenon on the Tees, Ure, Swale, and other rivers. The uniform cross-section of the Tees near Barnard Castle, and of the Ure near Aysgarth, is peculiarly favourable to their formation and growth.

The cross-stream progressive waves observed by the author in the Whirlpool Rapids of Niagara are a secondary phenomenon arising from the varying amplitude of the familiar stationary waves, a variation which the author traces to its cause. When their interference occurs at the intersecting crest of two stationary waves there ensues one of those great leaps of water which present so splendid an appearance in these rapids. The author invites special attention to the points in which his explanation of these phenomena in Niagara Rapids differs from those hitherto current.

Tidal bores are the only form of progressive wave in rivers which had hitherto received much scientific attention. The author deals with the question of what determines the place of origin of the tidal bore in the River Severn, and what is the cause of its apparently capricious variation in magnitude. Briefly, the bore originates where the slope of the channel is steep, but in the *upper*, not the lower, part of the steep slope, because there is in the upper part no alternative channel among the sand-banks for the last-of-ebb and first-of-flood respectively to pursue, but at the end of a set of spring tides the flood has so far cut in the sand an alternative, straight channel that the height of the bore is reduced. An excess of land-water, on the contrary, so strengthens the ebb that it tends to make a deep, solitary, curved channel up which the flood must force its way, increasing the height of the bore.

[1] Abstract of a paper by Dr. Vaughan Cornish in the *Geographical Journal* for January.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Western University of Pennsylvania has conferred the honorary degree of LL.D. upon Sir Robert Ball, Sir Robert Cranston, Sir William Turner, Sir William Preece, Mr. Marconi, Dr. Chalmers Mitchell, Dr. John Rhys, the Rev. E. S. Roberts (Master of Caius College, Cambridge), and Mr. Edwin Abbey.

A CONFERENCE on the teaching of hygiene and temperance in the universities and schools of the British Empire will be held at the Examination Hall, Victoria Embankment, on St. George's Day, April 23. The chairman at the morning session will be Lord Strathcona, and at the afternoon session Sir John Gorst.

THE annual exhibition of students' work will be held at the Borough Polytechnic Institute on Saturday, April 20, from 6–9.30 p.m. The workshops, laboratories, drawing offices, girls' trade school, domestic economy rooms, and other departments of the institute will be open for inspection, and practical work will be carried on during the evening.

THE *Times* correspondent at Ottawa reports that the medical building of McGill University, Montreal, was destroyed by fire on April 16. The museum, with its priceless specimens, is ruined, but a portion of the valuable medical library was saved. The loss is placed at 100,000*l.*, of which 70,000*l.* is covered by insurance. The origin of the fire is unknown, but incendiarism is suspected.

THE accommodation provided at University of London, University College, for the schools of engineering and of architecture will be considerably extended before the beginning of the next session in October by the additional space which becomes available through the removal of University College School to Hampstead. The Andrews scholarships are offered for competition in May; one of these scholarships, value 30*l.*, in science and mathematics, is tenable in the school of engineering.

A PARTY of students of zoology from the Birkbeck College spent part of their Easter vacation in Jersey shore-collecting during the prevailing low tides. More than one hundred and fifty species of shore-life were obtained, illustrating nearly all the animal phyla. The success of the visit was in great part due to the advice and guidance of Mr. J. Sinel, formerly director of the Jersey Marine Biological Station. A selection from the species collected formed a very interesting exhibit at the annual exhibition meeting of the Birkbeck Natural History Society, which was held on Saturday evening, April 13.

THE reports from the universities and colleges which participated, during the year ended March 31, 1906, in the annual grant of 100,000*l.* made by Parliament for "university colleges in Great Britain," and from the three colleges in Wales which receive a grant of 4000*l.* each, have now been published (Cd. 3409) by the Board of Education. Much instructive information can be gathered from the income and expenditure accounts provided by the various institutions. With an income of 42,819*l.*, Birmingham University at the end of the year's working had a balance in its favour of 2557*l.* Leeds University, though it started the year with 1568*l.* in hand, after expending 45,744*l.* ended the year with 395*l.* only to the good. With an expenditure of 53,162*l.*, Liverpool had 532*l.* in hand at the end of the year. Manchester, with an income of 59,155*l.*, came to the close of the year with 131*l.* to the good. Sheffield, which in the year under consideration was still a university college, was with an income of nearly 25,000*l.* about 1500*l.* in debt at the end

of the year. Bristol, with a much smaller income, did not spend it all. Dundee just about made both ends meet. Bedford College, London, had a small deficit. King's College, London, with an income of 33,282*l.*, managed to save 618*l.* University College, London, spent rather more than its income. The college at Newcastle had a deficit. Nottingham had been adopting a saving policy with a view to future developments, and arrived at the end of the year with a good balance. Reading spent more than it received, and Southampton was in want of money. Though the conditions have been modified to some extent since the year with which the report deals, there is still the same careful and economical management required at all these colleges, and desirable improvements and developments have to be postponed for lack of funds. We hope it will not be long before the Government is able to provide more than 100,000*l.* for higher education, and that increased State aid will be supplemented by greater munificence on the part of our men of wealth.

A NEW era in the chemical department of the Scottish universities has been inaugurated by the erection of a chemical research laboratory at St. Andrews University by the munificence of Prof. Thomas Purdie, F.R.S., at a cost of about 9000*l.* Moreover, the 5000*l.* originally set aside by the University Court from the Carnegie trust

The Purdie Chemical Research Laboratory, University of St. Andrews.

quinquennial grant for buildings, &c., to aid in this work has, by a subsequent arrangement of the Court and the Carnegie trust, been constituted an endowment for the upkeep of the chemical research department. A teaching chemical laboratory had previously been presented to the University by the generosity of Mrs. Thomas Purdie, late of Castlecliffe. The former occupants of the chair, viz. Profs. Connel and Heddle, were distinguished in their way, viz., the former in regard to the dew point and other subjects, and the latter in mineralogy and the chemistry of minerals, but chemical research proper dates from Prof. Purdie's appointment in 1884, and has now been firmly established in the University. The substantial new building, which is seen in elevation in the accompanying illustration, provides still further facilities for post-graduate work. On the ground floor is a graduates' research laboratory with ten benches, each with high- and low-pressure water-taps, electric light and power, and there are also balance, operation, physical and dark rooms. Ventilation, light and heat are perfect, so that the workers are under the best possible conditions. On the second floor is the professor's laboratory for four workers, a library, museum, spacious lecture-room, and various preparation rooms. The progress of the University as a chemical research school has been rapid, for previous to 1884 the accommodation was altogether inadequate. Now the facilities for teaching and research are not behind those of any of the modern German institutions. Moreover, not only St. Andrews students, but other capable workers are welcomed. Working in conjunction with the professor or lecturer on organic chemistry, students qualify for various scholarships, *e.g.* the Berry, Carnegie, and 1851 Exhibition scholarship, the research degree of London University, and the D.Sc. degree. The school has especially been noted for its work in optical activity and the chemistry of the sugars, but other subjects of biological interest have also been dealt with.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. December 6, 1906.—"The Chemistry of Globulin." By William **Sutherland**. Communicated by Dr. C. J. Martin, F.R.S.

The author's object in the present paper is first to establish simple formulæ for the more important of the experimental results obtained by Hardy and Mellanby, then to interpret these in their bearing upon the chemistry of globulin in connection with a theory of colloids, and finally to find the molecular mass (weight) of globulin.

By expressing the experimental results of Hardy and Mellanby in simple formulæ, it is shown that the solution of globulin and its precipitation take place under simple conditions of chemical equilibrium. For example, if p is the fraction of a globulin suspension dissolved in a salt solution the concentration of which is the fraction q of C that is required just to dissolve the whole of the suspension, we get equation (1) $p(1-q)=Aq(1-p)$, in which A is the ratio of a velocity of solution to a velocity of precipitation. Mellanby's discovery of the dependence of M/C on valency and ionic velocity is applied to MA/C, M being molecular mass, and it is shown that when temperature varies, not only does MA/C depend upon the viscosity of the solvent water, but also on a function of temperature given in an equation which expresses the part played by globulin. It is noteworthy that this function has a minimum value about 40° C., near the temperature of warm-blooded animals.

For the precipitation of globulin by excess of $(NH_4)_2SO_4$, an equation is established, namely, $p(1+p)=28{\cdot}8(c-0{\cdot}152)$, p being the fraction which the precipitated globulin is of the whole, and c the concentration of the $(NH_4)_2SO_4$ solution in grams per cubic centimetre.

Then follow formulæ for the remarkable precipitation of globulin by acids from solution in neutral salts. From these it appears that three compounds of globulin react in producing this precipitate.

Section iv. is devoted to a theory of the colloidal state, namely, that a colloid consists of molecules which are chemically united neighbour to neighbour by the action of valencies which are usually latent.

According to this chemical theory of the colloidal state, the term molecule ceases to have a useful meaning when applied to a colloid, so the term semplar is used to name that structure which is repeated like a pattern in three dimensions through a colloid. By suppression of the colloid-producing valencies of doublets, a mass of semplars is caused to fall into a collection of separate molecules. In illustration of the usefulness of this theory, it is applied to show the dependence of the coagulating power of an ion on its valence. It is then applied also to explain the remarkable fact that the amount of globulin dissolved by